

Correlates of Secondhand Tobacco Smoke Exposure Among Persons with Severe and Persistent Mental Illness (SPMI) Accessing Community Mental Health Services

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Abstract To examine the correlates of secondhand tobacco smoke (SHS) exposure in a sample of individuals with severe and persistent mental illness (SPMI) accessing community mental health services. Cross-sectional data were collected from a voluntary sample of 788 individuals with SPMI. Nonsmokers were more likely to be exposed on the street or at a bus stop, in a park or public place; whereas smokers were more likely to report SHS exposure where they lived and at their friend's homes. In a multivariate model, only number of acquaintances who smoked and the number of sources of SHS exposure remained significantly associated with perceived frequency of SHS exposure when accounting for other correlates. There is a need for the enactment and enforcement of policies to curtail SHS exposure in outdoor, public, settings. Future research will be necessary to better understand the extent and impact of SHS exposure in this population.

Keywords Secondhand tobacco smoke exposure · Mental illness · Community mental health · Tobacco use and mental illness

Introduction

Secondhand tobacco smoke (SHS) exposure increases the risk for adverse physical health outcomes including cancer (Bonner et al. 2005; Brennan et al. 2004; Gorlova et al. 2006), respiratory illness (Chan-Yeung and Dimich-Ward 2003; Prescott 2008), and cardiovascular disease (Barnoya and Glantz 2005; Makomaski Illing and Kaiserman 2004; Pitsavos et al. 2002). SHS, which consists of a mixture of the smoke of both the burning end of tobacco products (side stream smoke) and that exhaled by smokers (main-stream smoke), is a major source of indoor air pollution containing a complex mixture of up to 4,000 chemicals, more than 50 of which are cancer-causing agents (Jaakkola and Jaakkola 1997; National Cancer Institute 1999.; Rothberg et al. 1998). Specifically, 'fine particles,' that is, particulate matter that is less than 2.5 μm in diameter ($\text{PM}_{2.5}$), are released in substantial amounts from burning cigarettes and are easily inhaled deep into the lungs where they increase the risk for lung cancer, lung and heart disease, and death (Pope et al. 2002).

In recent decades, tobacco control strategies have targeted the promotion of smoke-free laws to decrease the health risks of SHS exposure to the general public particularly in public spaces (Brownson et al. 1997); and improved health outcomes have been observed as a result of restricting SHS exposure in various settings (Hahn et al. 2006; Khuder et al. 2007; Sargent et al. 2004). Municipalities with strong laws restricting smoking in public spaces have been associated with decreased SHS exposure among residents (Pickett et al. 2006). Although indoor smoking restrictions have been shown to dramatically lower air pollution from SHS exposure (Lee et al. 2008; Travers et al. 2004), the estimated harm associated with SHS exposure in outdoor public spaces has not been fully

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quantified (Klepeis et al. 2007). However, the recent US Surgeon General's report "*The health consequences of involuntary exposure to tobacco smoke: A report of the Surgeon General*" cautions that there is no known 'safe' level of SHS exposure (U.S. Department of Health and Human Services 2006).

Individuals with severe and persistent mental illness (SPMI) have a higher smoking prevalence than the general population (Grant et al. 2004; Lasser et al. 2000; Waxmonsky et al. 2005), placing them at increased risk for related morbidity and mortality. Given the higher smoking prevalence in this population, the risk for SHS exposure among smokers and nonsmokers with SPMI should be an issue of concern. Yet, SHS exposure in this population is understudied. Apart from reducing the hazards of SHS exposure among nonsmokers, smoking restrictions in mental health facilities and chemical dependency treatment units are also designed to promote smoking cessation among individuals living with mental illness (Lawn and Pols 2005; Patten et al. 1996). However, these restrictions may have only a temporary effect on smoking cessation in in-patient settings (Prochaska et al. 2006). Indeed, few studies have assessed SHS exposure among individuals in community settings. Prochaska et al. (2006) found that individuals with SPMI that are homeless or live in a half-way house or residential community report greater SHS exposure as compared to those who live in their home. In fact, it has been purported that many environments which individuals living with psychiatric illnesses frequent, are permissive to smoking, and, largely ignore the effects of SHS exposure (Williams and Ziedonis 2004); potentially placing them at higher risk for the adverse effects of SHS exposure.

Furthermore, important gender, diagnosis, and demographic differences exist among individuals with SPMI in terms of tobacco use behavior. Beratis et al. (2001) found that male patients with schizophrenia had a higher smoking frequency than female patients. Another study by de Leon et al. (2002) found that a higher proportion of daily smokers were patients with schizophrenia as compared to patients with mood disorders (83 vs. 65%). Similarly, Diwan et al. (1998) found that individuals with schizophrenia spectrum disorders (i.e., schizophrenia and schizoaffective disorder) were more likely (OR 12.0, 95% CI [3.6, 40]) to be *current smokers* as compared to individuals with affective disorders (i.e., major depression or bipolar depression). However, despite differences in daily and current smoking, both groups (i.e., individuals with schizophrenia spectrum disorders and those with mood/affective disorders) have similar levels of nicotine dependence (de Leon et al. 2002; Diwan et al. 1998). Studies have further documented that tobacco use among individuals living with mental illness is associated with lower

education levels (Miller et al. 2000) and possible racial differences (Morris et al. 2006). Some of these factors [for example gender (Pickett et al. 2006), educational attainment (Stamatakis et al. 2002), socioeconomic status (Whitlock et al. 1998), and age (Stamatakis et al. 2002)] are also associated with SHS exposure, and may warrant careful consideration in understanding SHS exposure among individuals with SPMI.

Given the high rates of smoking among individuals with SPMI and the potential risk for SHS exposure, the purpose of our study was to examine the correlates of SHS exposure in this population. Our specific aims were to:

- a. Describe the frequency, sources, and feelings towards SHS exposure among individuals with SPMI accessing community mental health services.
- b. Assess factors (i.e., gender, demographics, living situation, primary diagnosis, and substance use history) associated with SHS exposure among smokers and nonsmokers with SPMI accessing community mental health services.

Methods

Participants and Sampling

This study is based on a cross-sectional analysis of survey data obtained from adults receiving services from community mental health teams in Vancouver, British Columbia. During the time of the study, Vancouver had a municipal smoke-free law in which smoking was prohibited in all public places, including restaurants, bars, billiard halls, bingo halls, bowling alleys, casinos; but designated smoking rooms (DSRs) were permitted occupying maximum 10% of floor space. A convenience sample (we could not obtain a random sample due to concerns regarding confidentiality) was obtained by voluntary participation of individuals from the population receiving mental health services ($n = 788$). Only individuals with active health records and who were participating in adult care programs, at the time of the study, were deemed eligible. Participants in our study were representative of eight of the nine (88.8%) mental health teams in Vancouver. All study participants were residing in the community and were able to communicate and be understood in English, Mandarin, Cantonese, or Punjabi.

Data collection transpired from October 2005 to October 2006. Each community mental health team was approached by research staff and information about the study was provided. Patient recruitment occurred during regular operating hours by a research assistant at the mental health team offices. Potential participants were introduced to the

survey either by their case manager or the reception desk personnel. Flyers with information about the study were also distributed in the office waiting areas. Study procedures were explained by the research staff and written informed consent was obtained prior to administering the questionnaire. Participants received a \$10 gift card from a local grocery store upon completion of the questionnaire. Ethical approval for this project was obtained from the Behavioural Research Ethics Board of the University of British Columbia; and approval to conduct the research was obtained from Vancouver Coastal Health, Vancouver Community Health Service Delivery Area.

Measures

Demographic Variables

We obtained information on participants gender (male, female, transgendered, or other), relationship status (i.e., married and living with spouse/common law, separated/divorced, widowed, single and never married), education level (i.e., less than high school education, some high school or high school completed, trade certification or some community college/university, or community college/university completed), and living situation (live alone, live with friends or family, live in a group home, or other), and age (in years). In our sample, only six individuals identified themselves as 'transgendered' or selected the 'other' category, and were thus excluded from the main analyses.

Primary Diagnosis

Primary diagnosis was determined by a series of steps including asking participants information regarding their current known mental health diagnosis with a confirmatory chart review. Of the patients whose information could be identified either verbally or by chart review ($n = 729$) patients were organized into four main diagnostic categories: schizophrenia, schizoaffective disorder, mood disorder, and anxiety disorder.

Smoking Status

Smoking status was determined by a series of questions determining tobacco use. Individuals who responded "no" to the questions "Have you ever smoked cigarettes" and "Have you smoked over 100 cigarettes in your lifetime?" were classified as nonsmokers. In addition, participants who answered "yes" to both questions were further asked "when did you have your last smoke?" with the potential responses being "Today" coded as 1, "Last 30 days" coded as 2, "Last 2 months" coded as 3, "3–6 months

ago" coded as 4, and "more than 6 months ago" coded as 5. Current smokers were classified as individuals who responded "Today" and "Last 30 days". All others were classified as nonsmokers. Furthermore, as recommended by Okoli et al. (2008) we asked participants "Do you consider yourself a current smoker" (response choices were "yes" or "no") to determine their perceived smoking status. Kappa agreement between individuals we classified as nonsmokers versus current smokers (i.e., current smokers had smoked more than 100 cigarettes in their lifetime and had smoked in the past 30 days) and the participants' report of their perceived smoking status was .954 (18 individuals who considered themselves non-smokers had smoked within the past 30 days), indicating high agreement.

Substance Use

Substance use was determined by asking patients "how many days in the past month (last 30 days) did you use..." with substance choices including *alcohol, heroin, methadone, opium/codeine/pain killers like Tylenol 3, sedatives, hypnotics/tranquilizers like valium or xanax, cocaine or crack, amphetamines like speed or E or meth, marijuana (weed, pot), hallucinogens like LSD or mushrooms, inhalants like glue/paint thinner/ gas, and any other substance*. These items were obtained from the substance use section of the Addiction Severity Index (ASI) (McLellan et al. 1985, 1992). A summary score was computed for the number of substances used in the past 30 days, potentially ranging from 0 to 11 substances.

Sources of SHS Exposure

SHS exposure was determined by identifying *sources* of exposures. Participants were asked, "Are you exposed to second hand smoke in the following places..." with the ability to respond either 'yes' or 'no' to the following sources: 'where you live', 'on the street or at a bus stop', 'at your family's home', 'at your friends homes', 'at a drop-in center', 'at a coffee shop, bar, or restaurant', 'in a park/public space', 'any other place(s)'. A summary score was computed for the number of sources of SHS exposure, potentially ranging from 0 to 8 sources. The number of sources of SHS exposure has been used to determine SHS exposure in other studies (Mack et al. 2003; Okoli et al. 2007).

The *perceived frequency of SHS exposures* was determined by asking participants, "how often are you exposed to secondhand smoke (other people's smoke)" with response choices 'not at all', 'sometimes', 'frequently', and 'all the time'. Individuals who responded 'not at all' or 'sometimes' were grouped together as having 'low

exposure, coded as 1, and individuals responding ‘*frequently*’ or ‘*all the time*’ were categorized as having ‘moderate/high’ exposure, coded as 2; thus creating a binary measure ‘low versus moderate/high’ exposure. Similar measure of SHS exposure has been used in other studies (Pilkington et al. 2007).

Acquaintances Who Smoke

The number of acquaintances who smoke was determined by asking participants “Of the people you spend most of your time with, how many of them smoke cigarettes?” With response choices ‘*almost none*’ coded as ‘1’, ‘*some*’ coded as ‘2’, ‘*about half of them*’ coded as ‘3’, and ‘*most of them*’ or ‘*all of them*’ coded as ‘4.’ This measure has been used in other studies (Norman et al. 1999).

Data Analysis

Descriptive analyses were used to describe the sample, including frequencies and means (*M*) with standard deviations (*SD*). We used a two-step model building procedure to determine variables to include in a logistic model assessing the correlates of perceived frequency of SHS exposure. In the first step, univariate logistic regression analyses were used to determine the unadjusted association between the perceived frequency of SHS exposure (low exposure versus moderate/high exposure) and demographic, smoking status, primary diagnosis, substance use, SHS exposure (i.e., number of sources of SHS exposure), and the number of acquaintances who smoke. In the second step, only variables that were associated with the perceived frequency of SHS exposure ($\alpha = .10$) were included in the final multivariate model. All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 15.0.

Results

Sample Description

More than one half of the sample were female with a mean age of 48.7 (*SD* = 12.1) years. Approximately half were smokers, nearly two-thirds were single and had never been married, 53% had either a trade certification or had completed university, and the most common diagnosis was schizophrenia (Table 1). Smokers were younger, more likely to be male, more likely to be married, and less likely to have completed community college/university than nonsmokers. Nonsmokers were less likely to live alone, less likely to be diagnosed with schizophrenia, and used fewer substances (on average) in the past month than

smokers (Table 1). Because nonsmokers and smokers differed significantly on key demographic variables, a further stratified analysis of the sample (by smoking status) was performed.

Differences in SHS Exposure and Smoking Status

There were significant differences in the smokers’ and nonsmokers’ *perceived frequency* and *sources* of SHS exposure, number of acquaintances who smoked, and reports of feeling bothered by SHS (Table 2). The main sources of SHS exposure for smokers were ‘On the street or at a bus stop’ (55.6%), ‘at a coffee shop, bar, or restaurant’ (52.3%), and ‘where you live’ (46.9%). The main sources of SHS exposure for nonsmokers were ‘On the street or at a bus stop’ (72.9%), ‘in a park/public space’ (50.3%), and ‘at a coffee shop, bar, or restaurant’ (48.3%). Smokers were more likely to report perceived moderate to high exposure to SHS as compared to nonsmokers (36.0 vs. 21.8%). Nonsmokers were more likely to report SHS exposure on the street or at a bus stop, in a park or public place, and from other sources (for e.g., car, school, and work); whereas smokers were more likely to report SHS exposure where they lived and at their friends’ homes. Furthermore, smokers were more likely to report that most or all of their friends smoked. Although nonsmokers reported fewer average number of sources of exposure than smokers, this difference was not significant ($P = .306$).

Correlates of Perceived Frequency of SHS Exposure

In the univariate analyses for the total sample, participants’ primary diagnosis, smoking status, number of substances used in the past 30 days, number of acquaintances who smoked, and number of sources of SHS exposure were significantly associated with participant’s perceived frequency of SHS exposure (Table 3). However, in the multivariate model with the total sample, only number of acquaintances who smoked and the number of sources of SHS exposure remained significantly associated with perceived frequency of SHS exposure when accounting for other correlates. Among nonsmokers, age, primary diagnosis, the number of substances used in the past 30 days, the number of acquaintances who smoked, and the number of sources of SHS exposure were the variables significantly associated with perceived frequency of SHS exposure in the univariate analyses. In the multivariate analyses only reporting that “some” or “most” acquaintances smoke and a greater number of sources of SHS exposure remained significantly associated with the perceived frequency of SHS exposure (Table 4). Similar results were obtained among smokers; being female, having “some”, “most” or “all” acquaintances smoke, and a greater number of sources

Table 1 Sample characteristics by smoking status ($n = 788$)

| Characteristics | Total sample | | Nonsmokers ($n = 416$) | | Smokers ($n = 372$) | | Difference ^a |
|--|--------------|------|--------------------------|------|-----------------------|------|-------------------------|
| | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % | |
| Gender ($n = 776$) | | | | | | | <.0001 |
| Male | 376 | 48.5 | 145 | 38.6 | 231 | 61.4 | |
| Female | 400 | 51.5 | 250 | 62.5 | 150 | 37.5 | |
| Relationship status ($n = 775$) | | | | | | | .041 |
| Married and living with spouse/common law | 85 | 11.0 | 54 | 13.7 | 31 | 8.1 | |
| Separated/divorced | 177 | 22.8 | 80 | 20.4 | 97 | 25.4 | |
| Widowed | 28 | 3.6 | 16 | 4.1 | 12 | 3.1 | |
| Single and never married | 485 | 62.6 | 243 | 61.8 | 242 | 63.4 | |
| Education ($n = 781$) | | | | | | | <.0001 |
| Less than high school education | 35 | 4.5 | 18 | 4.6 | 17 | 4.4 | |
| Some high school or high school completed | 332 | 42.5 | 134 | 34.0 | 198 | 51.2 | |
| Trade certification or some community college/university | 203 | 26.0 | 105 | 26.6 | 98 | 25.3 | |
| Community college/university completed | 211 | 27.0 | 137 | 34.8 | 74 | 19.1 | |
| Living situation ($n = 781$) | | | | | | | <.0001 |
| Live alone | 415 | 53.1 | 202 | 51.0 | 213 | 55.3 | |
| Live with friends or family | 214 | 27.4 | 132 | 33.3 | 82 | 21.3 | |
| Live in a group home | 113 | 14.5 | 42 | 10.6 | 71 | 18.4 | |
| Other (for e.g. homeless, YMCA/shelter) | 39 | 5.0 | 20 | 5.1 | 19 | 4.9 | |
| Primary diagnosis ($n = 729$) | | | | | | | .004 |
| Schizophrenia | 338 | 46.4 | 152 | 45.0 | 186 | 55.0 | |
| Schizoaffective disorder | 98 | 13.4 | 52 | 53.1 | 46 | 46.9 | |
| Mood | 278 | 38.1 | 163 | 58.6 | 115 | 41.4 | |
| Anxiety | 15 | 2.1 | 5 | 33.3 | 10 | 66.7 | |
| | Mean | SD | Mean | SD | Mean | SD | |
| Age (in years, $n = 778$) | 48.7 | 12.1 | 50.1 | 12.4 | 47.2 | 11.6 | .003 |
| Number of substances used in past 30 days ($n = 771$) | 0.6 | 0.8 | 0.4 | 0.6 | 0.8 | 0.9 | <.0001 |

^a Differences between nonsmokers and smokers groups is based on chi-square analyses for categorical variables and Mann–Whitney *U* test for continuous and ordered categorical variables

of SHS exposure remained significantly associated with the perceived frequency of SHS exposure when accounting for other correlates (i.e., the number of substances used in the past 30 days and education level, which were associated with perceived frequency of SHS exposure in the univariate analyses).

Discussion

The link between tobacco use and mental illness is well established (de Leon and Diaz 2005; Dombrowski et al. 2005; Fergusson et al. 2003; Ostacher et al. 2006). However, little is known about the degree to which individuals with SPMI may be exposed to SHS in the community. Hence, the findings of our explorative study may provide a basis for future research.

First, it is of interest to note that in our sample, individuals with schizophrenia and anxiety disorders were more likely to be smokers than those with mood disorders and schizoaffective disorder. These findings are supported by other studies indicating high smoking prevalence among individuals diagnosed with schizophrenia and anxiety disorders, relative to other diagnoses (de Leon et al. 2002; Diwan et al. 1998; McCabe et al. 2004). However, this finding should be interpreted with caution given that only 2.1% ($n = 15$) of our sample had a diagnosis of anxiety disorder.

Second, in univariate analysis, perceived SHS exposure was not significantly associated with any demographic variables. Studies have shown that SHS exposure is associated with lower education, more frequent substance use, and being never married or separated/divorced (Iribarren et al. 2001). Although we found increased likelihood of

Table 2 Differences in SHS exposure between nonsmokers and smokers ($n = 788$)

| | Total sample | | Nonsmokers (<i>n</i> = 416) | | Smokers (<i>n</i> = 372) | | Difference ^a |
|--|--------------|------|------------------------------|------|---------------------------|------|-------------------------|
| | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % | <i>P</i> |
| Perceived frequency of SHS exposure (<i>n</i> = 770) | | | | | | | |
| Low | 549 | 71.3 | 309 | 78.2 | 240 | 64.0 | <.0001 |
| Moderate/high | 221 | 28.7 | 86 | 21.8 | 135 | 36.0 | |
| Sources of SHS exposure (<i>n</i> = 788) | | | | | | | |
| Where you live | 296 | 37.6 | 113 | 28.4 | 183 | 46.9 | <.0001 |
| On the street or at a bus stop | 507 | 64.3 | 290 | 72.9 | 217 | 55.6 | <.0001 |
| At your family's home | 109 | 13.8 | 48 | 12.1 | 61 | 15.6 | .145 |
| At your friends homes | 272 | 34.5 | 106 | 26.6 | 166 | 42.6 | <.0001 |
| At a drop-in center | 219 | 27.8 | 99 | 24.9 | 120 | 30.8 | .065 |
| At a coffee shop, bar, or restaurant ^b | 397 | 50.4 | 193 | 48.5 | 204 | 52.3 | .284 |
| In a park/public space | 369 | 46.8 | 200 | 50.3 | 169 | 43.3 | .052 |
| Other (for e.g., car, school, work) | 130 | 16.5 | 81 | 20.4 | 49 | 12.6 | .003 |
| Acquaintances who smoke (<i>n</i> = 774) | | | | | | | |
| Almost none | 337 | 43.5 | 254 | 64.6 | 83 | 21.8 | <.0001 |
| Some | 178 | 23.0 | 76 | 19.3 | 102 | 26.8 | |
| About half | 85 | 11.0 | 29 | 7.4 | 56 | 14.7 | |
| Most/all of them | 174 | 22.5 | 34 | 8.7 | 140 | 36.7 | |
| Bothered by SHS exposure (<i>n</i> = 770) | | | | | | | |
| Not at all | 243 | 31.6 | 46 | 11.7 | 197 | 52.4 | <.0001 |
| A little bit | 166 | 21.6 | 82 | 20.8 | 84 | 22.3 | |
| Somewhat | 131 | 17.0 | 80 | 20.3 | 51 | 13.6 | |
| A great deal | 230 | 29.9 | 186 | 47.2 | 44 | 11.7 | |
| | Mean | SD | Mean | SD | Mean | SD | <i>P</i> |
| Number of sources of SHS exposure (<i>n</i> = 788) | 2.9 | 1.8 | 2.8 | 1.7 | 3.0 | 2.0 | .306 |

^a Differences between nonsmokers and smokers groups is based on chi-square analyses for categorical variables and Mann–Whitney *U* test for continuous and ordered categorical variables

^b Of those reporting exposure in a coffee shop, bar, or restaurant, 5.3% of respondents were exposed *inside* the venue, 78.3% were exposed *outside* the venue, and 16.3% reported exposure both inside and outside the venue

perceived SHS exposure among individuals with lower education, and those with increased number of substances used in the past 30 days, these associations were non-significant (i.e., overlapping confidence intervals). However, we found important differences between nonsmoking and smoking individuals with SPMI in their perceived frequency of exposure, proportion of acquaintances who smoke, and feeling bothered by SHS exposure. Only 21.8% of nonsmokers in our present study reported moderate/high SHS exposure. This finding is lower than studies in the US, using biomarkers of exposure (i.e., serum cotinine) which estimate that 43% of the non-smoking population have evidence of SHS exposure using a strict serum cotinine level cut-off of 0.05 ng/ml (Pirkle et al. 2006). Not surprisingly, smokers reported higher perceived frequency of SHS exposure and a greater proportion of acquaintances

that smoked, but felt less bothered by SHS exposure as compared to nonsmokers. These findings are similar to other studies that have demonstrated that smokers are less bothered by SHS exposure (Cameron et al. 2003; Pilkington et al. 2006) and are more likely to have friends and acquaintances who smoke (Ennett and Bauman 1993) than nonsmokers. Although there appears to be a relatively low proportion of perceived exposure among participants in our study (i.e., 28.7% were classified as having moderate/high exposure), it is possible that our measure of SHS exposure may underestimate actual exposure. Future studies should incorporate more accurate measures of SHS exposure (including biomarkers) to estimate SHS exposure in this population.

Third, we found that significant correlates of perceived frequency of SHS exposure among participants in our study

Table 3 Correlates of perceived frequency of SHS exposure (Total sample $n = 704$)

| Characteristics | Univariate | | | | Multivariate | | | |
|--|------------|-----|-------|------------|--------------|-----|-------|------------|
| | <i>B</i> | SE | Odds | 95%CI | <i>B</i> | SE | Odds | 95%CI |
| Gender | | | | | — | — | — | — |
| Female | .11 | .16 | 1.12 | .81–1.53 | | | | |
| Male ^a | | | 1.0 | | | | | |
| Relationship status | | | | | — | — | — | — |
| Married and living with spouse/common law | .12 | .26 | 1.12 | .68–1.86 | | | | |
| Separated/divorced | .06 | .20 | 1.06 | .72–1.55 | | | | |
| Widowed | −.61 | .50 | .55 | .20–1.46 | | | | |
| Single and never married ^a | | | 1.0 | | | | | |
| Education | | | | | — | — | — | — |
| Less than high school education ^a | | | 1.0 | | | | | |
| Some high school or high school completed | −.27 | .38 | .77 | .36–1.62 | | | | |
| Trade certification or some community college/university | −.34 | .39 | .72 | .33–1.55 | | | | |
| Community college/university completed | −.57 | .40 | .57 | .26–1.24 | | | | |
| Living situation | | | | | — | — | — | — |
| Live alone | −.45 | .35 | .64 | .32–1.26 | | | | |
| Live with friends or family | −.71 | .37 | .49 | .23–1.01 | | | | |
| Live in a group home | −.14 | .39 | .87 | .41–1.85 | | | | |
| Other (for e.g. homeless, YMCA/shelter) ^a | | | 1.0 | | | | | |
| Primary diagnosis | | | | | | | | |
| Schizophrenia | −1.23 | .55 | .29* | .10–.86 | −1.21 | .61 | .30* | .09–.99 |
| Schizoaffective disorder | −1.09 | .58 | .34 | .11–1.05 | −.96 | .65 | .38 | .11–1.37 |
| Mood | −1.23 | .56 | .29* | .10–.87 | −1.11 | .62 | .33 | .10–1.11 |
| Anxiety ^a | | | 1.0 | | | | | |
| Age (in years) | −.01 | .01 | .99 | .98–1.00 | — | — | — | — |
| Smoking status | | | | | | | | |
| Nonsmoker ^a | | | 1.0 | | | | | |
| Current smoker | .70 | .16 | 2.02* | 1.47–2.78 | −.01 | .21 | .99 | .66–1.51 |
| Number of substances used in past 30 days | .41 | .10 | 1.51* | 1.25–1.83 | .12 | .11 | 1.13 | .91–1.42 |
| Acquaintances who smoke | | | | | | | | |
| Almost none ^a | | | 1.0 | | | | 1.0 | |
| Some | 1.05 | .23 | 2.86* | 1.81–4.51 | .79 | .26 | 2.21* | 1.33–3.69 |
| About half | 1.48 | .28 | 4.38* | 2.55–7.53 | 1.32 | .32 | 3.72* | 2.01–6.90 |
| Most/all of them | 2.05 | .25 | 7.80* | 5.02–12.10 | 1.79 | .28 | 5.96* | 3.47–10.23 |
| Number of sources of SHS exposure | .40 | .05 | 1.50* | 1.36–1.65 | .29 | .06 | 1.34* | 1.20–1.49 |

* $P < .05$ ^a Indicates the reference group

included *primary diagnosis*, *acquaintances who smoked*, and the *number of sources of SHS exposure*. No known studies have assessed SHS exposure by diagnostic differences. We found that individuals diagnosed with anxiety disorder were more likely to perceive having a moderate/high exposure to SHS than other diagnoses. It is uncertain whether this finding is a result of the specific nature of anxiety disorders in producing a heightened perception of SHS exposure, or if individuals with anxiety disorder, by virtue of smoking more, have higher SHS exposure.

Studies with more adequate sample sizes (particularly to account for differences by diagnosis) may be required to both validate and extend these findings. Furthermore, studies have demonstrated that one of the strongest predictors of SHS exposure is the number of friends and family members who smoke (Brownson et al. 1997; Cummings et al. 1990). However, the most prevalent sources of SHS exposure reported by participants (both smokers and nonsmokers) in our present study were on the street or bus stops, a coffee shop/bar/restaurant, and in a

Table 4 Correlates of perceived frequency of SHS exposure by smoking status

| Characteristics | Nonsmokers (<i>n</i> = 361) | | | | Smokers (<i>n</i> = 365) | | | |
|--|------------------------------|------|-------|------------|---------------------------|-----|-------|------------|
| | <i>B</i> | SE | Odds | 95%CI | <i>B</i> | SE | Odds | 95%CI |
| Gender | | | | | | | | |
| Female | – | – | – | – | .56 | .26 | 1.72* | 1.05–2.89 |
| Male ^a | | | | | | | 1.0 | |
| Education | | | | | | | | |
| Less than high school education ^a | – | – | – | – | | | 1.0 | |
| Some high school or high school completed | | | | | –1.14 | .64 | .32 | .09–1.13 |
| Trade certification or some community college/university | | | | | –1.10 | .67 | .33 | .09–1.23 |
| Community college/university completed | | | | | –.95 | .68 | .39 | .10–1.48 |
| Primary diagnosis | | | | | – | – | – | – |
| Schizophrenia | –1.59 | 1.03 | .20 | .03–1.55 | | | | |
| Schizoaffective disorder | –1.29 | 1.08 | .28 | .03–2.28 | | | | |
| Mood | –1.75 | 1.03 | .17 | .02–1.32 | | | | |
| Anxiety ^a | | | 1.0 | | | | | |
| Age (in years) | –.01 | .01 | .99 | .97–1.02 | – | – | – | – |
| Number of substances used in past 30 days | .31 | .22 | 1.37 | .90–2.09 | .15 | .14 | 1.16 | .89–1.51 |
| Acquaintances who smoke | | | | | | | | |
| Almost none ^a | | | 1.0 | | | | | |
| Some | .82 | .35 | 2.27* | 1.16–4.47 | .83 | .44 | 2.28 | .97–5.37 |
| About half | .56 | .54 | 1.74 | .61–4.99 | 1.70 | .47 | 5.45* | 2.18–13.63 |
| Most of them | 1.72 | .45 | 5.58* | 2.29–13.57 | 1.90 | .42 | 6.66* | 2.95–15.03 |
| Number of sources of SHS exposure | .42 | .10 | 1.52* | 1.25–1.83 | .24 | .07 | 1.28* | 1.12–1.46 |

Only variables that were significantly associated with perceived frequency of SHS exposure in the first step are included in the final model

* $P < .05$

^a Referent group

park/public space. Although we did not quantify the intensity and duration of SHS exposure from these sources, these may be important sources to target for smoke-free policies, given that these sources are public spaces in which individuals with SPMI frequent. This is particularly true for the street or bus stops where 64% of the sample (73% of nonsmokers and 56% of current smokers) reported being exposed to SHS. Recent studies have demonstrated significant duration and intensity of SHS exposure in outdoor settings (i.e., sidewalk café's, outdoor restaurant patio's), particularly with close proximity to the smoking source (Klepeis et al. 2007). Our findings strengthen the growing call for restrictions of smoking in *outdoor public settings*, given that there is no known 'safe' level of SHS exposure (US Department of Health and Human Services 2006) and that even intermittent exposure can result in adverse cardiovascular (Burghuber et al. 1986; Otsuka et al. 2001) and respiratory (Eisner et al. 2005) outcomes.

Several limitations need to be taken into account in interpreting the findings of this present research. First, no objective measure of SHS exposure (e.g., air nicotine monitoring or biomarkers) was determined and perceived

SHS exposure was used as the main outcome measure. Although the perceived SHS exposure has been used in previous studies (Pilkington et al. 2007), it may not be the most reliable measure of SHS exposure (Al-Delaimy and Willett 2008); where feasible, future studies should incorporate validated objective measure of SHS exposure. Second, as this is a cross-sectional analysis no causal relationships can be inferred between the correlates and the main outcome variable. Future studies employing longitudinal methods would provide more information regarding the correlates of SHS exposure in this population. Third, because this study was a convenience sample, the findings may not be representative of the SPMI population in Vancouver, BC at large; however, our sample was obtained from eight out of nine Mental Health Teams in Vancouver. The Mental Health Teams are multidisciplinary teams (including nurses, rehabilitation therapists, psychiatrists, physicians, psychologists, occupational therapists, social workers, and support staff) provide a mix of staff and services to provide for and reflect the needs of each community health area population, providing services for child, youth, adults, and older adults. The findings of our study

may not be reflective of geriatric individuals with SPMI, which were not represented in our sample. Although the prevalence of individuals with SPMI in Canada is largely unknown, our study sample has age and gender characteristics similar to those found among individuals with SPMI in other countries (Ruggeri et al. 2000).

No known study to date has assessed the correlates of SHS exposure among individuals with SPMI accessing community mental health services. Our findings indicate that SHS exposure among individuals with SPMI may be an issue of public health concern. The important sources of exposure (for example, streets and bus stops, coffee shop, bar, restaurants, parks and public spaces) highlighted by participants in our study indicate the need for the enactment and enforcement of policies to curtail SHS exposure in outdoor, public, settings. SHS exposure in such community settings may have serious adverse cognitive and behavioral implications for both individuals with SPMI and their families, friends, and health care providers. For example, studies have shown impaired cognitive development of children exposed to SHS (Yolton et al. 2005), increased psychopathology among individuals with prenatal exposure to SHS (Gatzke-Kopp and Beauchaine 2007), and reported nicotine withdrawal like symptoms (i.e., irritability, poor concentration, insomnia) among non-smokers exposed to SHS (Okoli et al. 2007). Apart from the potential behavioral effects of SHS exposure, the increased risk for adverse physical health outcomes is clear. Given some of the important limitations of our study, future research with sounder measures of SHS exposure (i.e., passive nicotine monitors, biomarkers etc.) will be necessary to better understand the extent and impact of SHS exposure in this population.

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